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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/551,553	10/03/2005	Toshihiko Tanaka	067161-0301	3832

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EXAMINER	
JELSMA, JONATHAN G	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/551,553	TANAKA, TOSHIHIKO	
	Examiner	Art Unit	
	Jonathan Jelsma	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 October 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10/03/2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *07/17/2006, 10/03/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Summary

1. This is the initial office action based on application 10/551,553 filed on 10/03/2005 by Toshihiko Tanaka.

2. Claims 1-17 are currently pending and have been fully considered.

Specification

3. The disclosure is objected to because it contains an embedded hyperlink and/or other form of browser-executable code. Applicant is required to delete the embedded hyperlink and/or other form of browser-executable code. See MPEP § 608.01 VII. See page 2 of the specification.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-2, 5-6, and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by LIN (US 2002/0168593 A1).

6. With respect to claims 1, 5, and 17. LIN teaches an optical proximity correction method applicable to a photolithographic process (paragraph 0016) for the formation of semiconductor devices (paragraph 0005). LIN uses P/S polarized light to expose a Y-

direction pattern 302, and X-directional pattern 304, being orthogonal to each other (paragraph 0025, and Fig. 3). The two mask patterns 302 and 304 are corrected patterns, such that the pitch of the X-directional pattern $c_x > c_y$ the pitch of the Y-directional pattern (paragraph 0026), therefore the two mask patterns have a geometry different from each other. The two mask patterns then form a resist patterns that has the same pitch/size for both the Y-directional and X-directional photoresist patterns (paragraph 0025) therefore the two photoresist patterns have the same geometry and are orthogonal to each other.

7. With respect to claims 2 and 6. Additionally defining the first direction as the Y-directional pattern, which is parallel to the S- polarized light (Figs. 3- 4A). Additionally the first mask pattern 302, has a larger width than the second mask pattern 304, since the pitch of the second pattern 304 is larger than the pitch of the first mask pattern 302 (paragraph 0027 and Fig. 3). This greater pitch leads to a smaller pattern size for the second pattern (see Fig. 3) in order to adjust for optical proximity correction (paragraph 0018).

8. Claim 15 is rejected under 35 U.S.C. 102(b) as being anticipated by INOUE (US 5,673,103).

9. INOUE teaches an exposure technique for forming fine patterns for the manufacture of semiconductor integrated circuits using polarized light (column 1 lines 8-12). INOUE further teaches an exposure apparatus for illuminating a photomask having first and second patterns respectively elongated in the X-axis and Y-axis directions,

being orthogonal to each other (column 5 lines 32-36). The illumination system may comprise an illumination device, such as a mercury lamp 11, a mask 21, projective lens 23 (column 9 lines 48-67, column 10 lines 1-5, and figure 8). Light incident from the mercury lamp is polarized through a polarizer in an X and Y direction which is arranged such that their directions coincide with each other (column 10 lines 10-26, 63-65).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

12. Claims 4, and 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over LIN (US 2002/0168593 A1).

13. Claim 4 is dependent upon claim 1, and claim 8 is dependent upon claim 5, both of which are rejected above under 35 U.S.C. 102(b) in view of LIN. The specific examples of LIN show the method of adjusting the linewidth of the mask pattern for

optical proximity correction (paragraphs 0018 and 0026). However, LIN does not explicitly give an example of forming a protrusion on the corner of the mask patterns with different geometries.

14. LIN does however teach that along with adjusting the linewidth of the mask patterns, the use of hammerheads or serifs can be used for the correction (paragraph 0018), where the serif is an protrusion on the corner of a mask feature.

15. Therefore, at the time of the invention one having ordinary skill in the art would have been motivated to not only vary the pitch and size of the mask pattern based on the pattern orientation (paragraph 0014), but to also include the use of serifs (paragraph 0018) in order to obtain a photoresist pattern of the same pitch/size for the Y-directional as well as X-directional photoresist pattern (paragraph 0025).

16. With respect to claim 9. LIN teaches an optical proximity correction method applicable to a photolithographic process (paragraph 0016) for the formation of semiconductor devices (paragraph 0005). LIN uses P/S polarized light to expose a Y-direction pattern 302, and X-directional pattern 304, being orthogonal to each other (paragraph 0025, and Fig. 3). The two mask patterns 302 and 304 are corrected patterns, such that the pitch of the X-directional pattern $c_x > c_y$ the pitch of the Y-directional pattern (paragraph 0026), therefore the two mask patterns have a geometry different from each other. The two mask patterns then form a resist patterns that has the same pitch/size for both the Y-directional and X-directional photoresist patterns (paragraph 0025) therefore the two photoresist patterns have the same geometry and are orthogonal to each other.

17. LIN does not explicitly teach, in their example that the pattern is an isolated pattern. However, LIN does teach that the photomask may be comprised of a plurality of patterns, and that two patterns with different orientations are selected to apply the optical proximity correction models (paragraph 0016). Therefore, at the time of the invention one having ordinary skill in the art would have been motivated to apply the optical proximity correction method of LIN to any variety of patterns, including isolated patterns, in order to obtain a photoresist pattern with the same pitch/size for the Y-direction and X-direction (paragraph 0025).

18. Claims 3 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over LIN (US 2002/0168593 A1) in view of OHNUMA (US 6,492,078 B1).

19. Claim 3 is dependent upon claim 1, and claim 7 is dependent upon claim 5, both of which are rejected above under 35 U.S.C. 102(b) in view of LIN. The specific examples of LIN show the method of adjusting the linewidth of the mask pattern for optical proximity correction (paragraphs 0018 and 0026). However, LIN does not explicitly give an example of forming a recess on the corner of the mask patterns with different geometries.

20. LIN does however teach that along with adjusting the linewidth of the mask patterns, the use of hammerheads or serifs can be used for the correction (paragraph 0018). LIN does not explicitly teach that the serif formation may be in the shape of a recess on the corner of mask pattern.

21. OHNUMA, however, teaches a method of performing optical proximity effect correction (column 4 lines 33-42). OHNUMA teaches that a serif pattern may be formed in the inner portion of a corner of a mask pattern in order to create a recessed shape in the inner corner to correct for the optical proximity effect (column 6 lines 38-53, Fig. 3C).

22. At the time of the invention one having ordinary skill in the art would have been motivated to use the serif recess forming method as taught by OHNUMA in the inner corner of the mask pattern of LIN with the different dimensions, in order to correct for the optical proximity effect (OHNUMA column 6 lines 52-53).

23. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over LIN (US 2002/0168593 A1) in view of SASAKI (US 2002/0136967 A1).

24. LIN teaches an optical proximity correction method applicable to a photolithographic process (paragraph 0016) for the formation of semiconductor devices (paragraph 0005). LIN uses P/S polarized light to expose a Y-direction pattern 302, and X-directional pattern 304, being orthogonal to each other (paragraph 0025, and Fig. 3). The two mask patterns 302 and 304 are corrected patterns, such that the pitch of the X-directional pattern $c_x > c_y$ the pitch of the Y-directional pattern (paragraph 0026), therefore the two mask patterns have a geometry different from each other. The two mask patterns then form a resist patterns that has the same pitch/size for both the Y-directional and X-directional photoresist patterns (paragraph 0025) therefore the two photoresist patterns have the same geometry and are orthogonal to each other. Additionally defining the first direction as the Y-directional pattern, which is parallel to

the S- polarized light (Figs. 3- 4A). Additionally the first mask pattern 302, has a larger width than the second mask pattern 304, since the pitch of the second pattern 304 is larger than the pitch of the first mask pattern 302 (paragraph 0027 and Fig. 3). This greater pitch leads to a smaller pattern size for the second pattern (see Fig. 3) in order to adjust for optical proximity correction (paragraph 0018) therefore is dimensionally corrected by an amount varied between the vertical and horizontal directions.

25. LIN teaches the photolithographic process for the formation of semiconductor devices (paragraph 0005), but does not explicitly teach that the semiconductor includes a memory cell portion and a peripheral circuitry portion

26. SASAKI teaches a photomask which can be used for manufacturing semiconductor circuits (abstract). Specifically SASAKI teaches the formation of a memory circuit which comprises a memory circuit portion, with patterns regularly arranged, and a peripheral circuit portion with irregularly arranged patterns (paragraph 0049).

27. At the time of the invention one having ordinary skill in the art would have been motivated to use the method LIN of using polarized light, and optical proximity correction methods to define a pattern, to create a semiconductor circuit such that described by SASAKI with a memory circuit portion and circuit portion in the peripheral in order to create a desired semiconductor circuit which is arranged to ensure connection to exterior (SASAKI paragraph 0049). SASAKI teaches a desired arrangement for a semiconductor circuit (paragraph 0049), and LIN teaches a method

of using optical proximity correction using polarized light in order to obtain patterns with the same pitch/sizes (paragraph 0025).

28. Claims 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over LIN (US 2002/0168593 A1) in view of CHEN (US 5,242,770).

29. LIN teaches an optical proximity correction method applicable to a photolithographic process (paragraph 0016) for the formation of semiconductor devices (paragraph 0005). LIN uses P/S polarized light to expose a Y-direction pattern 302, and X-directional pattern 304, being orthogonal to each other (paragraph 0025, and Fig. 3). The two mask patterns 302 and 304 are corrected patterns, such that the pitch of the X-directional pattern $c_x > c_y$ the pitch of the Y-directional pattern (paragraph 0026), therefore the two mask patterns have a geometry different from each other. The two mask patterns then form a resist patterns that has the same pitch/size for both the Y-directional and X-directional photoresist patterns (paragraph 0025) therefore the two photoresist patterns have the same geometry and are orthogonal to each other. Additionally defining the first direction as the Y-directional pattern, which is parallel to the S- polarized light (Figs. 3- 4A). Additionally the first mask pattern 302, has a larger width than the second mask pattern 304, since the pitch of the second pattern 304 is larger than the pitch of the first mask pattern 302 (paragraph 0027 and Fig. 3). This greater pitch leads to a smaller pattern size for the second pattern (see Fig. 3) in order to adjust for optical proximity correction (paragraph 0018) therefore is dimensionally corrected by an amount varied between the vertical and horizontal directions.

30. However, LIN does not explicitly teach the method of using a subpattern smaller in width than the main pattern and that sandwiches the main pattern.

31. CHEN teaches a method for reducing proximity effects during pattern transfer (column 3 lines 49-50). These proximity effects are reduced by the addition of thin lines, referred to as intensity gradient leveling bars into the mask pattern (column 3 lines 63-65). These leveling bars are often equal to one fifth of the critical dimension for the circuit design (column 4 lines 24-26), and are therefore smaller than the main pattern, additionally the size of the bars are related to the size of the main pattern. These bars improve pattern transfer consistency, by placing the bars parallel to isolated edges such that the intensity gradient leveling occurs on all isolated edges of the mask pattern (column 4 lines 1-5). An example of these include the addition of leveling bars so that they are sandwiching the main pattern (see Figs. 5A and 6A).

32. Therefore at the time of the invention one having ordinary skill in the art would have been motivated to use the intensity leveling bars as taught by CHEN to adjust the intensity gradients on isolated patterns of the mask of LIN in order to improve pattern transfer consistency (CHEN column 4 lines 3-5).

33. Claims 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over LIN (US 2002/0168593 A1) in view of SASAKI (US 2002/0136967 A1).

34. LIN teaches an optical proximity correction method applicable to a photolithographic process (paragraph 0016) for the formation of semiconductor devices (paragraph 0005). LIN uses P/S polarized light to expose a Y-direction pattern 302, and

X-directional pattern 304, being orthogonal to each other (paragraph 0025, and Fig. 3). The two mask patterns 302 and 304 are corrected patterns, such that the pitch of the X-directional pattern $c_x > c_y$ the pitch of the Y-directional pattern (paragraph 0026), therefore the two mask patterns have a geometry different from each other. The two mask patterns then form a resist patterns that has the same pitch/size for both the Y-directional and X-directional photoresist patterns (paragraph 0025) therefore the two photoresist patterns have the same geometry and are orthogonal to each other. Additionally defining the first direction as the Y-directional pattern, which is parallel to the S- polarized light (Figs. 3- 4A). Additionally the first mask pattern 302, has a larger width than the second mask pattern 304, since the pitch of the second pattern 304 is larger than the pitch of the first mask pattern 302 (paragraph 0027 and Fig. 3). This greater pitch leads to a smaller pattern size for the second pattern (see Fig. 3) in order to adjust for optical proximity correction (paragraph 0018) therefore is dimensionally corrected by an amount varied between the vertical and horizontal directions.

35. However, LIN does not explicitly teach that the pattern is a hole pattern.

36. SASAKI teaches an example of where the photomask used has a hole pattern to be transferred to the wafer (column 15 lines 36-37). This hole pattern may additionally be formed on a half-tone phase shift mask to have a very small dimensional difference between the coarse and dense portion of the hole patterns (column 15 lines 40-42).

37. At the time of the invention one having ordinary skill in the art would have been motivated to use the semiconductor production method of LIN to have the mask pattern of the hole pattern on a half tone phase shift mask as taught by SASAKI in order to

transfer the desired pattern and achieve very small dimensional difference between the coarse and dense portions (SASAKI column 15 lines 40-42).

38. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over INOUE (US 5,673,103) in view of MIZUTANI (US 4,864,123).

39. Claim 16 is dependent upon claim 15 which is rejected above under 35 U.S.C. 102(b) in view of INOUE. INOUE does not explicitly teach that the second linearly polarized light has an amplitude of 2-20% of that of the first linearly polarized light.

40. MIZUTANI however teaches the relationship between the amplitudes of the P-polarized light and S-polarized light which is perpendicular, based on the angle of incidence and angle of refraction (column 6 lines 52-64).

41. Therefore, the amplitude of the polarized light is a result effective variable, and one having ordinary skill in the art would be motivated to adjust the amplitude of the linearly polarized light based on the angle of incidence and angle of refraction based on the equations of MIZUTANI.

Conclusion

42. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan Jelsma whose telephone number is (571)270-5127. The examiner can normally be reached on Monday to Thursday 7:00 a.m. - 5:00 p.m.

43. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on (571)272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

44. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mark F. Huff/
Supervisory Patent Examiner, Art Unit 1795

JGJ